Can We Learn from Oppenheimer in Responding to Climate Change?

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I first visited the city of Los Alamos, New Mexico, in the summer of 2013—a diversion as I headed for a nearby retreat center, Ghost Ranch, which had offered respite years ago to several Manhattan Project scientists as they worked to create the atomic bomb.

At the time, I was working on another issue with existential risks —climate change—for then-U.N. Secretary-General Ban Ki-moon. But my journey to New Mexico was also deeply personal; my father had recently died after a long struggle with dementia, and I sought a quiet place in nature to heal.

The last book my father and I shared, before his mind left him, was the magisterial biography American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer, which was the basis for this summer's must-see movie.

Today, after two more visits to Los Alamos, I am still grappling with some of the questions raised by the dawn of the nuclear age and their potential relevance to other challenges we currently face, including planetary warming. What, if anything, might we learn from those who, in 1945, ushered in an era unlike any before?

Could they provide any insights for how we might deal with potential responses to human-generated climate change, including how the world might govern an emerging climate-altering technology called solar radiation modification (SRM) , also known as solar geoengineering?

In their intent and impact, of course, SRM and nuclear weapons are diametrically opposed: The latter is about ending lives; the former is about trying to save them.

SRM describes a suite of approaches that deliberately seek to reflect sunlight back into space to lower the planet's temperature. It includes the idea of spraying sulfate aerosols into the stratosphere to form a sun shield around the Earth, mimicking what happens after a large volcanic explosion.

SRM could potentially turn down the Earth's temperature within a few years , bringing relief from extreme heat and related climate impacts for countless millions, including some of the world's most climate-vulnerable communities and future generations.

It would not, however, address the cause of climate change, and at best would be a supplement, not a substitute, for mitigation and adaptation. It could divert or deter the political will needed to strengthen these essential efforts. Researchers say a global deployment of SRM would require decades, if not a century or more, to have full impact, as simultaneous efforts to reduce emissions and remove a sufficient amount of atmospheric carbon—SRM's exit strategy—would take this long.

SRM would also introduce new risks , both known and unknown—from potentially harming the ozone layer and altering precipitation patterns, to risking serious harm to biodiversity if it were suddenly terminated, to triggering or exacerbating conflicts if deployment were to adversely impact—or even be perceived to negatively impact—a neighboring country. It would affect all countries, but it would not do so equally .

One of the greatest risks posed by SRM, a technology with planetary effect, is the absence of comprehensive international guardrails and guidelines. Key questions remain unanswered: Who would control the global thermostat? Who would decide if it should be deployed, based on whose authority or legitimacy , using whose data, and under what conditions?

In the immediate postwar period, Oppenheimer—along with Niels Bohr, Leo Szilard, Albert Einstein, and other scientists—called for international control of atomic energy. Oppenheimer thought the bomb's horrific destructiveness would make future wars with atomic weapons unthinkable and spur efforts to find peaceful alternatives—a line of thinking similar to those before him who thought World War I was the 'war to end all wars.'

The nascent United Nations, he thought, could be a forum for oversight and collaboration between countries to harness atomic energy for peaceful purposes and control the proliferation and use of nuclear weapons. His efforts, however, failed to convince the U.S. administration, and the U.S.-Soviet arms race sped ahead.

The ultimate goal of nuclear weapons governance is to prevent their further use, reduce their numbers to zero, and halt global proliferation. With SRM, the objectives are to create a comprehensive international framework to minimize its potential risks and maximize its potential benefits as well as to knit together the governance of research, development, demonstration, and potential deployment.

It is unclear at this stage if SRM's potential benefits would outweigh its known and unknown risks. Would a world in which temperatures overshoot the 1.5-degree-Celsius benchmark and possibly double that by 2100, which is the trajectory we are on now , be better than a world in which SRM is deployed? Better for whom? Who wins, who loses, and who decides?

These technologies also raise fundamental questions about humanity's role in the larger tapestry of life, as do artificial intelligence, quantum computing, and synthetic biology. To channel a phrase Oppenheimer used in his farewell address to the Association of Los Alamos Scientists in 1945, could they mark 'a change in the nature of the world'?

The scientists working on the Manhattan Project at Los Alamos were working for the U.S. government, whose goal was to develop an atomic bomb to win a war. The aim of SRM researchers is to limit the suffering that will result from accelerating climate change. Their goal is not a weapon, but a salve.

Unlike the atomic age, which was ushered in with a flash of sudden, blinding light at the Trinity test site, the existential risks from climate change have been unfolding for some time.

As climate impacts intensify, however, there is a growing risk that countries or even non-state actors might rush to use SRM. After all, it is a seductive technique: easy to deploy, cheap, and fast acting. Given that it would affect all countries if ever used, the lack of international oversight seems negligent at best, and enormously dangerous at worst.

I currently work with a small nongovernmental organization seeking to jump-start the international governance of SRM. Our message is simple: Whether one supports, opposes, or is unsure about SRM, it needs to be governed, and this must include the voices and views of all countries, including the most climate-vulnerable.

Recently, there has been some policy attention paid to SRM. The White House, under congressional mandate, released a potential research agenda , and the European Union has called for international talks. However, only a small percentage of policymakers, let alone the public, is aware of SRM and the enormous implications of its potential use.

Governance is much more than a technical issue. It is the human element that is so vexing—and personal. What does deliberately altering the climate mean for us as human beings, our relationship with other species, and our responsibilities toward future generations? Will artificial intelligence—with all its promises and perils—enhance the quality of life or, as some experts fear, increase the risks of ending it?

Can, as Bohr and Oppenheimer once argued, civic governance—in the broader sense of transparent, society-wide public dialogue and debate —help us answer these questions and avoid the pitfalls? How do we also enable scientific inquiry, innovation, creativity, and collaboration—values that Oppenheimer strongly supported—to flourish?

For all our modern-day sophistication, we are still playing with Promethean fires. Humanity's influence on Earth is embedded in the very ground we stand on. In the age of the Anthropocene , which began shortly after the atomic bomb was dropped, we have increased the extinction of species, altered ecosystems, and changed the climate for millennia to come.

Hubris will not serve us well: Meddling in the playground of the gods was always risky business.

The time has come for a society-wide conversation to address SRM. Young people, who will inherit the consequences of our decisions, must have their voices heard. We also need to hear from climate-vulnerable communities, faith leaders , and philosophers, for this is a discussion about ethics , beliefs , and values as well as science.

More than seven decades into the Anthropocene, it's clear we are still far from answering some of the most fundamental questions surrounding technologies—including SRM and artificial intelligence—with planetary import.

Climate change is taking us into a world that humans have never known before. We would be wise to approach this inflection point in human history with a spirit of humility, recognizing that the consequences of our actions in the next few years will be with us for millennia, reshaping the landscape of life as we know it, including in the ochre-colored deserts of New Mexico.

This article was written in the author's personal capacity.

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